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Artificial Intelligence Review
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Deep learning models and traditional automated techniques for brain tumor segmentation in MRI: a review

Parvathy Jyothi[1] · **A. Robert Singh**[2]

Abstract

Brain is an amazing organ that controls all activities of a human. Any abnormality in the shape of anatomical regions of the brain needs to be detected as early as possible to reduce the mortality rate. It is also beneficial for treatment planning and therapy. The most crucial task is to isolate abnormal areas from normal tissue regions. To identify abnormalities in the earlier stage, various medical imaging modalities were used by medical practitioners as part of the diagnosis. Magnetic Resonance Imaging (MRI) is a non-invasive diagnostic tool used for analyzing the internal structures owing to its capability to provide images with high resolution and better contrast for soft tissues. This survey focuses on studies done in brain MRI. Manual segmentation of abnormal tissues is a time-consuming task, and the performance depends on the expert's efficiency. Hence automating tumor segmentation plays a vital role in medical imaging applications. This study aims to provide a comprehensive survey on recent works developed in brain tumor segmentation. In this paper, a systematic literature review is presented to the reader to understand three policies, namely classical scheme, machine learning strategy, and deep learning methodology meant for tumor segmentation. Our primary goal is to include classical methods like atlas-based strategy and statistical-based models employed for segmenting tumors from brain MRI. Few studies that utilized machine learning approaches for the segmentation and classification of brain structures are also discussed. After that, the study provides an overview of deep learning-based segmentation models for quantitative analysis of brain MRI. Deep learning plays a vital role in the automatic segmentation of brain tissues. Presently deep learning technique outshines traditional statistical methods and machine learning approaches. An effort is made to enclose the literature on patch-based and semantic-based tissue segmentation presented by researchers working in the discipline of medical imaging. The manuscript discusses the basic convolutional neural network architecture, Data Sets, and the existing deep learning techniques for tissue segmentation coupled with classification. This paper also attempts to summarize the current works in Convolutional Neural networks and Autoencoders that assist researchers in seeking future directions. Finally, this article is concluded with possible developments and open challenges in brain tumor segmentation.

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WILEY

RESEARCH ARTICLE

SABOS-Net: Self-supervised attention based network for automatic organ segmentation of head and neck CT images

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Abstract

The segmentation of Organs At Risk (OAR) in Computed Tomography (CT) images is an essential part of the planning phase of radiation treatment to avoid the adverse effects of cancer radiotherapy treatment. Accurate segmentation is a tedious task in the head and neck region due to a large number of small and sensitive organs and the low contrast of CT images. Deep learning-based automatic contouring algorithms can ease this task even when the organs have irregular shapes and size variations. This paper proposes a fully automatic deep learning-based self-supervised 3D Residual UNet architecture with CBAM(Convolution Block Attention Mechanism) for the organ segmentation in head and neck CT images. The Model Genesis structure and image context restoration techniques are used for self-supervision, which can help the network learn image features from unlabeled data, hence solving the annotated medical data scarcity problem in deep networks. A new loss function is applied for training by integrating Focal loss, Tversky loss, and Cross-entropy loss. The proposed model outperforms the state-of-the-art methods in terms of dice similarity coefficient in segmenting the organs. Our self-supervised model could achieve a 4% increase in the dice score of Chiasm, which is a small organ that is present only in a very few CT slices. The proposed model exhibited better accuracy for 5 out of 7 OARs than the recent state-of-the-art models. The proposed model could simultaneously segment all seven organs in an average time of 0.02 s. The source code of this work is made available at https://github.com/seeniafrancis/SABOSNet.

KEYWORDS

auto-contouring, deep learning, head and neck CT, organs at risk(OAR), radiation therapy, residual U-net, self supervision

1 | INTRODUCTION

Head and neck cancer has been reported globally as one of the most commonly occurring cancers, with many cases being diagnosed every year. One of the most commonly prescribed treatments for head and neck cancer patients is radiation therapy. Because of its very precise dose distribution to the target region, image-guided

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RESEARCH ARTICLE

ContourGAN: Auto-contouring of organs at risk in abdomen computed tomography images using generative adversarial network

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Abstract

Accurately identifying and contouring the organs at risk (OARs) is a crucial step in radiation treatment planning for precise dose calculation. This task becomes especially challenging in computed tomography (CT) images due to the irregular boundaries of the organs under study. The method currently employed in clinical practice is the manual contouring of CT images, which tends to be highly tedious and time-consuming. The results are also prone to variations depending on the observer's skill level, environment, or equipment types. A deep learning-based automatic contouring technique for segmenting OARs would help eliminate these problems and generate consistent results with minimal time and human effort. Our approach is to design a conditional generative adversarial network (GAN)-based technique for the semantic segmentation of OARs in abdominal CT images. The residual blocks of the generator network have a multi-scale context layer that explores more generic characteristics, greatly enhancing performance and lowering losses. A comparative analysis is undertaken based on various assessment measures widely employed in segmentation. The results show substantial improvement, with mean dice scores of 98.0%, 96.6%, 98.2%, and 86.1% for the respective organs—liver, kidney, spleen, and pancreas—in the abdominal CT. The proposed GAN-based model could accurately segment the four abdominal organs, including the liver, kidney, spleen, and pancreas. The obtained results prove that the suggested model is able to compete with existing state-of-the-art abdominal OAR segmentation techniques.

KEYWORDS

abdomen CT, auto-contouring, deep learning, generative models, OAR segmentation, radiation therapy, UNet

1 | INTRODUCTION

The rising number of cancer cases makes it incredibly important to facilitate a swift treatment planning process. A common method for treating cancer is radiotherapy, which requires computed tomography (CT) scans with accurately segmented organs at risk (OAR) for the treatment planning process of cancer. In the current clinical practice, manual segmentation is the most commonly used technique for OAR contouring, which is highly

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Prior-guided generative adversarial network for mammogram synthesis

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Mammogram

ABSTRACT

Deep Learning is vital in medical imaging solutions and clinical applications. However, multiple reasons, such as data scarcity and imbalance in the medical image dataset, cause performance issues in various deep learning models. Thus, generating synthetic medical data close to real images is an immediate need of time. The Mammographic Image Analysis Society (MIAS) dataset, the standard dataset for studying breast anomalies, suffers from a class imbalance problem as very few images correspond to malignant and benign cases are there compared to normal cases.

Methods: This paper proposes a data augmentation model based on Generative Adversarial Network (GAN) architecture to generate synthetic mammograms of different cases, such as normal, benign, and malignant. The proposed method's novelty lies in its capability of generating multiple variants of a class-labelled mammogram, which is more realistic in conserving the adherent breast tissue characteristics. These synthetic mammograms are a useful solution for resolving class imbalance problems.

Results: Generated samples of each class are added to the MIAS dataset to address the class imbalance problem. This study also demonstrates that the augmented dataset with cGAN-generated images has enhanced the 2-class- and 3-class breast cancer classification performance by 3.9%. The proposed cGAN model is efficient in capturing the features of abnormalities. The 90% of class-labelled mammograms generated by cGAN belong to the same class in the case of real medical data.

Conclusions: The proposed work exhibits the generation of synthetic mammograms using a GAN-based approach. Augmentation of the training dataset with GAN-generated images significantly enhances breast image classification.

1. Introduction

A mammogram is a specialised X-ray of human breast tissues, and its analysis helps us identify breast anomalies. The significant abnormalities detected from the mammogram are the presence of breast mass, size, asymmetric density, suspicious calcification, architectural distortion, tissue retraction, and skin thickening. The breast masses can be benign (non-cancerous) or malignant (cancerous). Many image processing and machine learning algorithms are developed from mammograms for computer-aided breast cancer diagnosis. Computer-aided diagnosis requires a dataset of mammogram images. The health information records of the person are private and confidential [1]. The availability of clinical records for research is less due to data privacy policy ensured by constitutional laws. Mammographic Image Analysis Society (MIAS) dataset [2], the most easily accessible and common standard dataset, contains 322 original mammograms classified into normal, benign, and malignant based on the presence and type of anomalies. It also includes the truth benchmarking from radiologists about the location of the mass and other abnormalities. The MIAS dataset has two significant limitations; small dataset size and class imbalance problem. About 64% of the total images are of normal mammograms. The benign and malignant classes of images are significantly fewer in number. The recent deep learning models, such as automated breast cancer detection models based on transfer learning [3] and Convolution Neural Network (CNN) model by [4], use the MIAS dataset with traditional augmentation methods to increase the size of the dataset.

Deep learning networks for classification task provides promising results for different clinical imaging applications. However, the medical image datasets available are not optimal for deep learning-based research; creating, analysing, and annotating massive data and using it to develop automated techniques in deep learning research

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Identification of Pedestrian Crash Prone Locations and Mitigation Measures

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ABSTRACT: In India, road crashes are one of the most important causes of death and health loss. Identifying and ranking high pedestrian crash prone locations plays a key role in developing efficient and effective strategies to enhance the pedestrian safety. The study discusses the present state of pedestrian accident information on National Highway (NH – 66) – a road stretches of 18.5 km which extends from North Paravur to Edappally. It includes collection of primary data and secondary data. Primary data collection includes road geometric data, traffic volume count and spot speed data. The safety analysis of the pedestrian and vehicular conflict at the Edappally Junction is done by Pedestrian – Vehicular Volume (PV^2) analysis. Secondary data collection includes collecting the accident data from 2017 – 2021 from the various police department and prioritizing the crash prone locations by using Crash Severity Index (CSI) method. CSI method follows a system of assigning scores based on the severity of crashes in that particular location. Then, provide remedial measures at the identified locations to reduce the road crashes and enhance the safety of pedestrians.

KEYWORDS: Crash Severity Index, Pedestrian safety, Pedestrian – Vehicular Volume, Remedial measures

I. INTRODUCTION

Walking is one of the most important travel modes in every country. Transportation system that encourages walking, it can reduce traffic congestion and improve the safety of motorist. Pedestrians are one of the vulnerable road users, have become more susceptible to traffic crashes with the rapid growth of motor vehicle in India. Pedestrian deaths in India have gone up from 13,894 in 2015 to 23,483 in 2020, as per Union Ministry of Road Transport and Highways. Rapidly increasing road crashes in India have an adverse impact on the social and economic development of the country. Road facilities in urban areas are still a significant source of harm to pedestrians. Every year, a large number of pedestrians are killed or seriously injured in crashes involving motor vehicles. Pedestrian safety is an issue in many urbanized areas throughout the world. To reduce the crash rates effectively, it is essential to concentrate on measures which improve the road safety and hence reduce the number of road crashes and its severity in particular. The pedestrian road crash is influenced by several human and environmental factors, roadway characteristics and vehicular characteristics.

The identification, analysis and treatment of crash prone locations are widely regarded as one of the most effective approaches to road crash prevention. Providing suitable remedial measures helps to improve the pedestrian safety at the identified locations. Pedestrian – Vehicular Volume analysis helps to check the safety of pedestrians at the selected location. The study was carried out on NH – 66, starting from North Paravur to Edappally. The road stretch is 18.5 km. This work also includes the study of identification and prioritization of pedestrian crash prone locations using Crash Severity Index (CSI) method.

II. LITERATURE REVIEW

S Tawar et al. [1] studies deal with the identification and analysis of crash clusters using Crash Severity Index (CSI) method. The study stretch is 48km on NH – 48 from Ambience Mall to Kapdiwas in Bilaspur Kalan. FIR data was collected for the past three years from 2015 to 2017 from the various police department. Prioritize and ranked the crash clusters for pedestrians based on the CSI method. Total 11 crash prone locations were identified and prioritized using CSI equation. This method is used in this work to prioritize and identify the pedestrian crash prone locations. Five pedestrian crash prone locations are identified and prioritized using this method. Srinivas S Pulgurtha et al. [2] identified high pedestrian crash zones. To rank high crash zones, techniques like crash frequency, crash density, crash rate, and composite methods have been employed frequently.

Greeshma et al. [3] studied pedestrian vehicular conflict at Vytilla Junction and PV^2 analysis were carried out. For cross movement analysis of pedestrians, the value of PV^2 has to be computed so as to identify the necessary pedestrian

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ORIGINAL RESEARCH PAPER

Pavement Condition Assessment Using Fuzzy Analytic Hierarchy Process

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Abstract
This study develops a fuzzy mathematical analysis called the Fuzzy Analytic Hierarchy Process (FAHP) for Pavement Condition Assessment (PCA) and prioritization by considering the functional and structural evaluation of pavement as well as traffic volume. The Pavement Condition Index (PCI), characteristic deflection, International Roughness Index (IRI), and Commercial Vehicles Per Day (CVPD) are identified as four performance indicators for PCA. Software for executing FAHP is developed using Python, providing performance indicator values as inputs, and the deliverable is the Fuzzy Pavement Priority Index (FPPI). The selected stretches of National Highway (NH) 66, State Highway (SH) 75, SH 61, and SH 51, in the Thrissur district of Kerala, India is prioritized from the Maintenance and Rehabilitation (M&R) aspect based on FPPI values from the software. FAHP, being a combination of the Analytic Hierarchy Process (AHP) and fuzzy logic, measures the degree of consistency in the judgments provided by a decision-maker and captures the subjectivity inherent in human judgment. The results demonstrate that the collected data serves as a good estimator to prioritize the stretches for M&R purposes. The proposed method, being a more scientific approach, serves as a base model for PCA and the developed software delivers FPPI values suitable for performing the differential ranking of stretches.

Keywords Fuzzy Pavement Priority Index · Pavement Condition Assessment · Analytic Hierarchy Process · Prioritization

1 Introduction

Pavement Condition Assessment (PCA) includes evaluating the existing condition of the pavement by assessing the distresses, prioritizing the selected pavement stretches for Maintenance and Rehabilitation (M&R) purposes based on deterioration rate, and forecasting future pavement conditions. Both structural and functional evaluations are required to identify the current condition of any pavement. The performance indicators in PCA are often subjective in nature and the rating of pavement distresses involves possibilities of variations in human judgements. Inconsistencies in data may be caused by the instruments used for data collection due to changes in field conditions. The present paper focuses on the development of a systematic approach to the Fuzzy Analytic Hierarchy Process (FAHP) for mitigating these variations in PCA and to develop software for prioritizing the selected stretches based on chosen performance indicators from M&R aspects. In this study, the functional performance of pavements is determined by assessing the type, severity, and quantity of distress through a detailed pavement condition survey and represented in terms of the pavement condition index (PCI). The pavement roughness is measured using Machine for Evaluating Roughness using Low-cost INstrumentation (MERLIN) and is defined in terms of the International Roughness Index (IRI). The Benkelman Beam deflection technique is used to structurally evaluate the pavement. From the deflection values, characteristic deflection is calculated. Traffic volume influences the efficiency and life of a pavement and thereby possess an impact on the M&R decisions. Thus, traffic volume data expressed in terms of Commercial Vehicles Per Day (CVPD) is also considered to

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Spectrum of corona products based on splitting graphs

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Let G be a simple undirected graph. Three new corona products of graphs based on splitting graph of G are defined. The adjacency spectra of the three new graphs based on splitting graph of G are determined. The number of spanning trees and the Kirchoff index of the new graphs are determined using their nonzero Laplacian eigenvalues.

Keywords: Corona product; splitting graph; adjacency spectrum; Laplacian spectrum.

Mathematics Subject Classification 2020: 05C50, 05C76

1. Introduction

Let G be an undirected simple graph with vertex set $V(G) = \{v_1, v_2, \ldots, v_p\}$. Adjacency matrix of G, $A_G = (a_{ij})$ is a symmetric matrix that takes the value 1 if the vertices v_i and v_j are adjacent and 0 otherwise. The characteristic polynomial of G (the characteristic polynomial of A_G) is given by $f_G(x) = \det(xI - A_G)$, where $xI - A_G$ is an invertible matrix. The set of real eigenvalues of A_G, $\{\lambda_1, \lambda_2, \ldots, \lambda_p\}$

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InGaAs based gratings for UV–VIS spectrometer in prospective mRNA vaccine research

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Abstract

During the outbreak of the COVID-19 illness, mRNA (messenger RNA) injections proved to be effective vaccination. Among the presently available analytical techniques, UV/VIS spectrophotometry is a trustworthy and practical instrument that may provide information on the chemical components of the vaccine at the molecular level. In this paper, we will present a one-dimensional grating of InGaAs as a prospect grating structure for UV–VIS spectrometer that can be used for mRNA vaccine development. The main parameters and the wavelength region used in mRNA vaccine development lies in the range of 200 nm to 700 nm (UV–VIS Range). The incorporation of new materials that are excellent for cutting-edge semiconductor industry procedures for MEMS manufacture, as well as new optimal parameters, will improve the grating and spectrometer's performance which will enhance the mRNA vaccine development and manufacturing workflows enabled by UV–VIS spectroscopy. Hence we evaluated the feasibility of the materials, Si (Silicon), GaN (Gallium Nitride), InGaAs (Indium Gallium Arsenide) and InP (Indium Phosphide) as a grating material. Reflection spectrum of the proposed structure shows 48% increase compared to the grating made up of Silicon. In order to model wave propagation in one grating unit cell, electromagnetic waves frequency domain interface is used. The periodic constraints of floquet periodicity are used for simulation at both faces of the unit cell. The reflectance of grating with each material as functions of the angle of incidence was plotted. Also we evaluated the effect of grating thickness, groove density, spectral resolution and efficiency over different materials namely Si, GaN, InGaAs and InP. After optimizing geometric parameters, the designed InGaAs based grating achieved a efficiency of 87.45% and can be a reliable prospect for mRNA based vaccine development.

Keywords mRNA vaccine · *COVID-19* · *Diffraction* gratings · Spectroscopy · MEMS · Optical materials

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Trustworthy Scan Design and Testability Using Obfuscation and Logic Locking Scheme for Wireless Network Application

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Mobile Networks and Applications

Aims and scope

Submit manuscript

M. I. Shiny & M. Nirmala Devi

Abstract

The wireless network (WN) has become an integral part of the living habits of human beings. Most of the crypto chips are broadly utilized in WN application to assure the security of information. The functional correctness of cryptographic devices should be verified to authenticate the precision of the secrecy of the information. In the IC industry correctness of the wireless sensing device can be verified by scan design-based testing. The scan chain-based testing is the most popularly used testing technique due to its increased fault coverage and improved test quality. It also acts as a hacking tool and recovers sensitive data through side-channel attacks like power, time, or hamming distance. This paper presents the state-of-art-of secure mechanism to protect the scan

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Theoretical study of TiO_2 based UV–VIS spectrometer gratings for assessment of skin lesions in localized scleroderma

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ABSTRACT

Objective: Reflectance Spectroscopy is a helpful device to evaluate the seriousness of hyperpigmentation and erythema in Local scleroderma lesions. This article highlight the design of one dimensional regular grating comprised of TiO_2 for the detection of skin lesions in localized scleroderma. The grating structure establishes the wavelength-dependent diffraction performance and it is required to theoretically recognize the optimum parameter for each application. The purpose of this study is to suggest a suitable grating with optimum parameters for assessing skin lesions.

Methods: In order to analyze the best material and grating parameters for the detection of skin lesions, we simulated grating structure with different materials namely SiO_2, SiN, Si_3N_4 and TiO_2 by employing the appropriate factors, notably the Index of refraction, groove density and thickness. The numerical simulation is carried out with the help of COMSOL Multiphysics, and the finite element technique is used to model the reflection related properties of SiO_2, SiN, Si_3N_4 and TiO_2 based fixed gratings.

Result: The quantity of hemoglobin (erythema) and melanin (hyperpigmentation) is measured in terms of erythema index (EI) and also melanin index (MI). After optimizing geometric parameters, the designed grating achieved. an efficiency of 95.45%. The calculated reflectance, spectral resolution, efficiency, EI and MI of TiO_2 based gratings are much higher than the similar geometry made up of other similar materials. The strong reflectance of TiO_2 and its high efficiency of 95.45% in the wide range of 200–800 nm made the proposed structure very reliable for skin lesions detection.

1. Introduction

Local scleroderma abbreviated as LoS is an uncommon inflammatory scarring disease of the connective tissue happening in grownups as well as in children. This condition influences primarily the skin, but less frequently the underlying tissue and only

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Intelligent Automation & Soft Computing
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Article

Novel L2CL-LCL Topology for Wireless Power Transmission PMSM Powered Electrical Vehicle

Jenson Jose[1,*] and Jose P. Therattil[2]

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Abstract: The Wireless Power Transmission (WPT) technology is a significant source of operation in the field of power transmission with tremendous potential in a wide range of applications. This paper proposes a novel strategy for L2CL-LCL topology, which comprises two capacitors and one inductor in the essential and one capacitor and one inductor in the auxiliary. Using MATLAB simulation, this paper compares the traditional DSLCL system and the proposed L2CL-LCL. The various parameters of this system are simulated. In the current system, input and output power are set to 200.1 and 182.4 W. The common framework's start to finish efficiency can be estimated as 90.10%. The input and output power for the proposed framework is 224.2 and 211.05 W. The proposed framework has a general efficiency of 95.2%, which is greater than the traditional system. The output of this topology is taken care of to an electric vehicle powered by Permanent Magnet Synchronous Motor. The efficiency of the electric vehicle gets improved to about 65.5%, which is better than the average efficiency of an electric vehicle. The various parameters of the electric vehicle are simulated. The experimental analysis also proves that the results provided closely resemble theoretical research, demonstrating the superiority of the proposed system.

Keywords: Power transmission; inductor; full-bridge inverter; electrical vehicle system; battery voltage

1 Introduction

Electrical energy assumes a crucial function for making human existence more helpful and agreeable. In many previous years, the transmission of electrical energy was done through wired networks. Nonetheless, the rise of utilizations like cell phones, electrically-controlled vehicles, space satellites, and biomedical implantable gadgets has required the need for exploration in Wireless Power Transfer (WPT) [1]. A compensation configuration is critical for a WPT framework since it decides the resonance frequency while limiting the power supply's volt-ampere rating, boosting coupling power transfer capacity, and accomplishing high efficiency [2–5].

Parallel-Parallel (PP), Parallel Series (PS), Series-Parallel (SP), and Series-Series (SS) are the four major compensation configurations [6]. PS and PP, which are parallel compensation topologies, are not suitable for a WPT. A voltage-source inverter lays a framework by generating large current spikes at switching transitions [7]. The adverse effects of powerless misalignment tolerance can be seen in SS and SP compensation topologies. As the coupling deteriorates, the input impedance decreases. When the coupling factor is set to zero, the input impedance is also set to zero. It is extremely harmful as the voltage source is short-circuited. As a result, SS and SP are not applicable, requiring a large separation between two coupling coils, such as dynamic electric vehicle (EVs) charging [8]. Commercializing wireless charging technology

Corporate social responsibility of Canara Bank – a systematic status review

R.V. Naveenan, T. Jarin and S.R. Boselin Prabhu

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Abstract

Critiques claim that the very concept of corporate social responsibility (CSR) is an agenda of the North, which has a narrow focus. Organisations devise a special system to undertake socially responsible activities and report the same. Such organisations are equally supported by banks that are considered to be one of the pillars of the society. Banks have a key role to perform, not only financially but also socially. As a part of society, they contribute to the society through its CSR activities. Thus, banks were observed to be involved in numerous social responsibility activities for the development of society. This study aims at analysing the trends in CSR activities of Canara Bank. This helps us to understand various contributions made by Canara Bank for various social improvement activities. The study is conducted to understand and analyse the various CSR activities accomplished by the bank.

Keywords

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Research Article EAI.EU

PI Controller Based Switching Reluctance Motor Drives using Smart Bacterial Foraging Algorithm

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Abstract

Optimization algorithms are commonly used in the industry. The optimization strategy, if key elements are ignored, can quickly render the solution unfeasible. As a result, various optimization strategies are applied at all aspects of the industry level. The switched reluctance motor is the most affordable of all motor types. The high torque density attribute of induction motors is one of the market's major drivers. Switched reluctance motors are also employed in high-volume and high-starting torque appliances. The Smart Bacterial Foraging Algorithm (SBFA) mimics the chemotactic behavior of E. Coli bacteria for optimization purposes. This method is used to calculate the coefficient of a typical Proportion–Integration (PI) speed controller for SRM drives while accounting for torque ripple reduction. The results of the modeling and experiments reveal that the modified PI controller with SBFA performs better. The proposed optimization strategy results in increased performance when compared to regular BFA.

Keywords: smart bacterial foraging algorithm, SRM motors, optimization, PI controller, PWM inverter.

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1. Introduction

The Smart Bacterial Foraging Algorithm (SBFA) controls the drive of a switching reluctance motor (SRM). SBFA mimics the chemotactic behavior of E.Coli bacteria to optimize its performance. This technique is used to calibrate the coefficients of a classic Proportion–Integration (PI) speed controller for SRM drives. Bacteria Foraging Optimization (BFO) is a novel type of biologically supported global search strategy that mimics E. coli bacteria's foraging behavior [1]. Switched reluctance motor is the least expensive of all the motor types. Air conditioning systems that are environmentally friendly for passenger trains, advanced weaving machine techniques, motor blower for vacuum cleaners, and food processor compact drives are some of the applications of switched reluctance motors. Switched reluctance motors are also used in high-volume appliances and those with a high starting torque. High torque density compared to induction motors is a major market driver [2].

A bacteria can engage in one of two foraging behaviors: tumbling or swimming. Swimming and tumbling are used to create chemotaxis. Swarming occurs when bacteria spread out from their positions in a ring of cells by reducing mean square error to a minimum value. To optimize means to find the optimum answer to a certain situation. Deterministic approaches are based on the computation of functions, derivatives, or approximations to those functions. Stochastic approaches use an "oriented random" approach to find the best result. Examples include engineering issues requiring low cost, great performance, and little loss. Researchers are attempting to combine BFOA with various other algorithms to investigate both its local and global search features. It has already been used to solve a variety of real-world issues, demonstrating its efficacy over a wide

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Chemosphere
Volume 307, Part 1, November 2022, 135762

Hybridization of long short-term memory with Sparrow Search Optimization model for water quality index prediction

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Abstract

Water quality (WQ) analysis is a critical stage in water resource management and should be handled immediately in order to control pollutants that could have a negative influence on the ecosystem. The dramatic increase in population, the use of fertilizers and pesticides, and the industrial revolution have resulted in severe effects on the WQ environment. As a result, the prediction of WQ greatly helped to monitor water pollution. Accurate prediction of WQ is the foundation of managing water environments and is of high importance for protecting water environment. WQ data presents in the form of multi-variate time-sequence dataset. It is clear that the accuracy of predicting WQ will be enhanced when the multi-variate relation and time sequence dataset of WQ are fully utilized. This article presents the Water Quality Prediction utilising Sparrow Search Optimization with Hybrid Long Short-Term Memory (WQP-SSHLSTM) model. The presented WQP-SSHLSTM model intends to examine the data and classify WQ into distinct classes. To achieve this, the presented WQP-SSHLSTM model undergoes data scaling process to scale the input data into uniform format. Followed by, a hybrid long short-term memory-deep belief network (LSTM-DBN) technique is employed for the recognition and classification of WQ. Moreover, Sparrow search optimization algorithm (SSOA) is utilized as a hyperparameter optimizer of the proposed DBN-LSTM model. For demonstrating the enhanced outcomes of the presented WQP-SSHLSTM model, a sequence of experiments has been performed and the outcomes are reviewed under distinct prospects. The WQP-SSHLSTM model has achieved 99.84 percent accuracy, which is the maximum attainable. The simulation outcomes ensured the enhanced outcomes of the WQP-SSHLSTM model on recent methods.

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Sustainable Energy Technologies and Assessments

Volume 52, Part B, August 2022, 102087

Modeling and control of a hybrid electric vehicle to optimize system performance for fuel efficiency

Chinju Saju [a], Prawin Angel Michael [a], T. Jarin [b]

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Abstract

The improvement of fuel economy and the environmental consequences are important societal goals. In this paper, the modeling and regulation of a hybrid electric vehicle is explored to optimize system performance for fuel-efficiency. The internal combustion engine is a part of the mechanical design, while controller design and electrical subsystem are a part of the electrical design. To improve fuel efficiency in a hybrid electric vehicle is to combine an electric motor, a battery, and an internal combustion engine. The electric motor assists the engine when accelerating, driving longer highways, or climbing hills. This enables the use of a smaller, more efficient engine. It also makes use of the concept of regenerative braking to maximize energy efficiency. Thus, the NEDC and UDDS driving cycles may not accurately represent the actual situation and are progressively being replaced to HWFET driving cycle. In this paper, the Adaptive Neuro-Fuzzy Inference System (ANFIS) controller was used to analyze the engine, motor performance, and the HWFET was used in the vehicle driving test using Matlab/Simulink. The controller will be based on both the desired driving speed and the battery charge level. The implementation of optimal control based on an adaptive neuro-fuzzy inference system that decreases internal combustion engine fuel consumption is the paper's main contribution.

Introduction

A novel control strategy for the adaptive real-time energy management of a commuter pull-in hybrid vehicle is proposed. The proposed strategy can adapt to various driving conditions so that fuel economy can be improved further in practice. Its main feature is that a Fuzzy Inference System (FIS) for online estimation

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Chemosphere

Volume 308, Part 1, December 2022, 136278

Adsorptive sequestration of noxious uranium (VI) from water resources: A comprehensive review

Sourav Prusty [a 1], Prathap Somu [b c 1], Jitendra Kumar Sahoo [a], Debasish Panda [a], Sunil Kumar Sahoo [d], Shraban Kumar Sahoo [e], Yong Rok Lee [b] ✉, T. Jarin [f], L. Syam Sundar [g], Koppula Srinivas Rao [h] ✉

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Abstract

Groundwater is usually utilized as a drinking water asset everywhere. Therefore, groundwater defilement by poisonous radioactive metals such as uranium (VI) is a major concern due to the increase in nuclear power plants as well as their by-products which are released into the watercourses. Waste Uranium (VI) can be regarded as a by-product of the enrichment method used to produce atomic energy, and the hazard associated with this is due to the uranium radioactivity causing toxicity. To manage these confronts, there are so many techniques that have been introduced but among those adsorptions is recognized as a straightforward, successful, and monetary innovation, which has gotten major interest nowadays, despite specific drawbacks regarding operational as well as functional applications. This review summarizes the various adsorbents such as Bio-adsorbent/green materials, metal oxide-based adsorbent, polymer based adsorbent, graphene oxide based adsorbent, and magnetic nanomaterials and discuss their synthesis methods. Furthermore, this paper emphasis on adsorption process by various adsorbents or modified forms under different physicochemical conditions. In addition to this adsorption mechanism of uranium (VI) onto different adsorbent is studied in this article. Finally, from the literature reviewed conclusion have been drawn and also proposed few future research suggestions.

Graphical abstract

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Sustainable Energy Technologies and Assessments

Volume 53, Part B, October 2022, 102526

Synthesis of biodiesel from castor oil catalyzed by sodium hydroxide dispersed on bentonite

Maisari Utami [a], Pandu Setiawan [b], Iip Izul Falah [b], Suheryanto [c], Muhammad Shidiq [d], Karna Wijaya [b], T. Jarin [e], C. Sumathijones [f], Omar H Abd- Elkader [g], Moaaz O H Abd-Elkader [h], Soon Woong Chang [i], Balasubramani Ravindran [i j]

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Abstract

The present study describes the production of biodiesel from castor plant (*Riccinus communis*) using heterogeneous base catalyst of NaOH dispersed on bentonite. The catalysts were prepared via wet impregnation by loading a known amount of NaOH on natural bentonite in various NaOH-to-bentonite ratios of 5%, 10%, 20%, and 25% (w/w). The prepared catalysts were characterized by AAS, FTIR, XRD, GSA, and SEM; and further used in a transesterification reaction at 60°C for 4h. The liquid yields were analyzed by FTIR and GC–MS, ^{1}H NMR, and ASTM. The modification of a larger concentration of NaOH led to decreasing the mineral structure of natural bentonite. The homogeneous distribution of NaOH on bentonite influenced the increasing pore size of catalyst compared to natural bentonite. The enhanced physicochemical properties significantly increased the catalytic activity. The transesterification reaction of castor oil into biodiesel over 25% NaOH/bentonite catalyst showed the highest conversion of 76.94% biodiesel yield. The obtained biodiesel properties was agreed with the ASTM standard specifications.

Introduction

Energy has become an important issue for human beings to continue economic growth and sustainable development. This leads to the energy demand continues to rise worldwide as well as the depletion of sources of petroleum. In order to reduce the dependence on petroleum, biodiesel becomes one of the alternative fuel resulted that the biodiesel industries are blooming in many countries [1], [2], [3], [4], [5].

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Sustainable Computing: Informatics and Systems

Volume 36, December 2022, 100813

Intelligent wild geese algorithm with deep learning driven short term load forecasting for sustainable energy management in microgrids

B. Deepanraj [a], N. Senthilkumar [b], T. Jarin [c], Ali Etem Gurel [d e], L. Syam Sundar [a], A. Vivek Anand [f]

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Abstract

Energy management in power grids becomes essential to reduce the cost for the consumer and improve the power supply reliability. The microgrid is a vital part of the smart grid and it requires intelligent power management approach for effective functioning. Presently, delivering demand load and sustaining energy are two major challenges that exist in the power system. To resolve these problems, short-term load forecasting (STLF) models have been presented as an effective management and energy supply mode in power systems. The recently developed deep learning (DL) and machine learning (ML) models can be employed for accurate STLF in microgrids. In this view, this study presents an intelligent wild geese algorithm with deep learning driven short term load forecasting (IWGADL-STLF) model for sustainable energy management in microgrids. The proposed IWGADL-STLF model intends to accurately and rapidly predict the STLF in the microgrids. To accomplish this, the IWGADL-STLF model uses attention based Bi-directional long short term memory (ABiLSTM) model which involves the input parameters as formation of household and commercial load profiles with commercial load profile of the microgrid as output. The proposed IWGADL-STLF model identifies the behavioural patterns of parameters and models the behaviour in short time period for effective prediction process. Since hyperparameters play a vital role in the DL models, in this study, WGA is applied as a hyperparameter optimizer of the ABiLSTM model. The IWGADL-STLF approach has shown effective results with low MAE, MAPE, and R^2 values. A comprehensive experimental analysis reported the enhanced performance of the presented model over the other existing approaches under several aspects.

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Renewable Energy Focus
Volume 43, December 2022, Pages 228-238

Fuel vehicle improvement using high voltage gain in DC-DC boost converter

T. Jarin [a], Stephy Akkara [b], S.S. Sreeja Mole [c], Arthi Manivannan [d], A. Immanuel Selvakumar [b]

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Abstract

Fuel cell electric vehicles (FCEV) are becoming increasingly popular among manufacturers as carbon dioxide emissions and fuel economy rules have become more stringent. Fuel-cell vehicles often have lower output voltages than those required by the DC bus; therefore, the output voltage decreases rapidly as the output current increases. In this critical circumstance, it is essential to have a DC-DC converter for FCEVs with a high switching frequency and voltage gain. Furthermore, DC-DC booster converters are used in FCEV systems to achieve a high voltage gain. Over a 40 V input range, MATLAB tests the modified converter for gains of approximately five times the input voltage gain. Furthermore, when the fuel cell was operational, a converter efficiency of approximately 90% was measured.

Introduction

Fuel cell electric vehicles (FCEVs) have gained popularity in the automotive industry owing to environmental concerns and limited fossil fuel supplies. Owing to advancements in fuel-cell technology and power electronics, FCEVs have advanced tremendously [1]. With fuel cells, their high reliability, high efficiency, minimal noise, and low operating temperatures make them ideal for the automotive industry. They are also known for their quick start and low operating temperature. The low-voltage fuel-cell supply must be linked to the high-voltage DC bus of the motor-driven inverter through a step-up DC-DC converter with a wide voltage gain range [2]. One of the most frequently utilised voltage ramping technologies is the DC-DC boost converter. In conventional boost converters, large voltage gains can be achieved when the duty cycles approach unity. A substantial voltage gain (e.g. over six) becomes impossible with parasitic

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| Vol. 36, No. 16, 2240005 (2022)

Liver Tumor Classification Using Optimal Opposition-Based Grey Wolf Optimization

No Access

Reshma Jose, Shanty Chacko, J. Jayakumar, and T. Jarin

https://doi.org/10.1142/S0218001422400055 | **Cited by:** 0 **(Source: Crossref)**

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This article is part of the issue:
Special Issue on Medical Image Processing with Advanced Artificial Intelligence Techniques
Guest Editors: Chi Lin, Chang Wu Yu and Ning Wang

Abstract

Image processing plays a significant role in various fields like military, business, healthcare and science. Ultrasound (US), Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) are the various image tests used in the treatment of the cancer. Detecting the liver tumor by these tests is a complex process. Hence, in this research work, a novel approach utilizing a deep learning model is used. That is Deep Belief Network (DBN) with Opposition-Based Learning (OBL)-Grey Wolf Optimization (GWO) is used for the classification of liver cancer. This process undergoes five major processes. Initially, in pre-processing the color contrast is improved by Contrast Limited Adaptive Histogram Equalization (CLAHE) and the noise is removed by Wiener Filtering (WF). The liver is segmented by adaptive thresholding following pre-processing. Following that, the kernelizedFuzzy C Means (FCM) method is used to segment the tumor area. The form, color, and texture features are then extracted during the feature extraction process. Finally, these traits are categorized using DBN, and OBL-GWO is employed to

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| Vol. 36, No. 16, 2240004 (2022)

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A Composite Medical Image Optimization Scheme Using Honey Encryption and Antlion Algorithms for Secured Diagnostic Systems

G. Jayahari Prabhu, B. Perumal, and T. Jarin

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This article is part of the issue:
Special Issue on Medical Image Processing with Advanced Artificial Intelligence Techniques
Guest Editors: Chi Lin, Chang Wu Yu and Ning Wang

Abstract

Medical imaging technology is one of the most critical applications necessitating data protection, particularly if we need to keep track of any important patient information. This medical imaging system employs encryption and decryption. Using several cryptographic techniques, the security key was established to protect the data. Every network that sends and receives data needs to be secure in some way. In this paper, ALO along with the encryption algorithm honey is used to enhance the security of medical imaging technologies, the proposed study uses a variety of ways to protect important health information. In comparison to the existing one, the proposed honey algorithm attains better results. Further, the antlion optimizer uses random keys throughout the encryption and decryption. In the next step, the keys are remodeled using antlion optimization. After that, the updated key is optimized by analyzing every element and generating paths that trigger

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Effects of long-term exercise training on physiological signals and personality traits in women in law enforcement

Article type: Research Article

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Abstract: Law enforcement teams across the globe experience the highest occupational stress and stress-related diseases. Physical exercise and an active lifestyle are recommended as part of their profession to equip them to fight stress and related health adversities. The research is carried out using objective measures of Heart Rate Variability (HRV), Electro Dermal Activity (EDA), Heart Rate Recovery (HRR), and subjective questionnaires. HRV was generated with an electrocardiogram (ECG) signal acquired using NI myRIO 1900 interfaced with the Vernier EKG sensor. HRR was acquired with the help of a Polar chest strap exercise heart rate monitor and EDA acquisition was carried out with Mindfield E-Sense electrodes. Then statistical features are extracted from the collected data, and feed to the AQCNN (Aquila convolution neural network) classifier to predict the stress. Signal analyses were done in Kubios 4.0, Ledalab V3.x in a MATLAB environment. The results pointed out that exercise training is effective in increasing the vagal tone of the Autonomic Nervous System (ANS) and hence improves the recovery potential of the cardiovascular system from stress. The proposed AQCNN method improves the accuracy by 95.12% which is better than 93.13%, 85.36% and 80.13% from Statistical technique, CNN and ML-SVM respectively. The findings have the potential to influence decision-making in the selection and training of recruits in high-stress positions, hence optimizing the cost and time of training by identifying maladaptive recruits early.

Keywords: Exercise training, ANS adaptation, machine learning, stress-recovery, heart rate variability, heart rate recovery, electrodermal activity

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Renewable Energy Focus
Volume 43, December 2022, Pages 309-316

Hybrid electric car comparison to increase the reliability for fuel efficiency

Chinju Saju [a], Parwin Angel Michael [a], Jarin T. [b]

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Abstract

Light electric vehicles, such as electric bicycles and electric scooters, have recently demonstrated remarkable promise over short distances. Light electric vehicles, such as peddles, electric bicycles, and electric scooters, have recently demonstrated remarkable promise for short-distance travel. Despite rising crude oil costs, the use of vehicles is increasing at an alarming rate. There is a pressing need to improve fuel economy while enhancing vehicle emission control to protect future generations from the consequences of pollution. HEV and EV have demonstrated the ability to improve the fuel efficiency. This research focuses on the parallel configurations of HEVs and their optimisation-based power management techniques as well as the possible benefits of various power management tactics in various vehicular applications. Research gaps are also highlighted as part of this enquiry. In this study, we examined three distinct methods. A thorough comparative study demonstrated how the controller affects the NEDC driving cycle, performance, losses, efficiency, and starting power of the HEV motor. As a result, the skilful integration of hybrid electric drive with lightweight, cost-effective optimization of efficiency, emissions, performance, and safety for production-worthy and marketable vehicles.

Introduction

Concerns about rising oil prices and environmental protection have compelled the automobile industry to accelerate the development of hybrid electric and fuel cell cars for broad market adoption. Because fuel cell-powered cars are still in the early phases of research, Hybrid Electric Vehicles (HEVs) appear to be the most economically viable option so far and for the foreseeable future [1], [2]. A hybrid propulsion system

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Applied Thermal Engineering
Volume 221, 25 February 2023, 119661

Numerical investigation on fully-developed heat transfer augmentation and friction factor with dimple shaped intrusion and different radius of curvatures on triangular ducts

L.B. Bharath Raju [a], G.R.K. Sastry [a], S.K. Gugulothu [a], K. Kesava Reddy [a], B. Deepanraj [b]

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Abstract

The heat transfer phenomenon is moderate in the case of triangular ducts due to the presence of sharp corners, which causes stagnant flow in the corners. Thus, this study focuses on improving heat transfer by converting one of the corners of the duct to a rounded structure having a variable curvature radius value (Rc). Rc varies from 0.67h (maximum value) to 0.33h (minimum value), where h is the height of the duct. Heat transfer and airflow have also been tested with dimple-shaped intrusion and rounded corners under varying ranges of relative length in the longitudinal direction (Z/e=10–18) and relative length in the transverse direction (X/e=10–18). Application of thermal-based boundary conditions on the turbulent flow for Re=5600–21,000 facilitates the heat transfer analysis in a duct under steady-state. The commercial software tool, ANSYS Fluent 18.1, is used to simplify-three dimensional Reynolds averaged Navier Stokes equation with the compressible fluid flow by considering the pressure-based solver with the standard K- ε turbulence model. Compared to a typical duct, the rounded corner area shows higher velocity because of the dimple intrusions and rounded corners. Introduction of curvature to the corner opposite to the heat-conducting surface in simple triangular duct results in the increment of heat transfer by 5.71–44.37%, 3.172–23.76%, and 1.16–8.27% for the values of Rc=0.33h, 0.49h, and 0.56h, respectively. Further the addition of dimple-shaped intrusion in the triangular duct with rounded corner, increases the heat transfer for Z/e=X/e=18 as visible from the increment in average Nusselt Number by 22.9–91.52%, 49.41–129.82%, 31.96–89.26% and 14.36–85% for Rc=0.333h, 0.49h, 0.56h & 0.67h respectively for Re spanning from 5600 to 21000.

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Journal of Materials Research and Technology
Volume 21, November–December 2022, Pages 3154-3168

Original Article

Thermal and thermo-mechanical studies on seashell incorporated Nylon-6 polymer composites

P. Vasanthkumar [a], R. Balasundaram [b], N. Senthilkumar [c], K. Palanikumar [d], K. Lenin [e], B. Deepanraj [f]

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https://doi.org/10.1016/j.jmrt.2022.10.117

Abstract

Towards environmental sustainability, recycling and effective usage of sea wastes are encouraged to develop novel materials in engineering applications by sustainable waste management. In this research, impact of seashell (SS) particles (75μm) of varying weight fractions (0, 3, 6, 9, 12,15 and 18%) reinforced in nylon-6 matrix is investigated experimentally by studying its thermal properties viz., vicat softening temperature (VST), heat deflection temperature (HDT), coefficient of linear thermal expansion (CLTE), and melt flow index (MFI) and thermo-mechanical properties by thermo-gravimetric analysis (TGA), dynamic mechanical analysis (DMA), and differential scanning calorimetry (DSC) according to ASTM guidelines. The polymer matrix composite (PMC) is prepared by blending the pellets of nylon-6 and seashell particles with the help of twin-screw extruder and fabricated into the required shape and size in an injection moulding machine. Outcomes of the experimental investigation show that CLTE decreases with increase in SS content, whereas VST and HDT deflection temperature increases along with the weight % of SSs due to the reduction in plasticity of the thermoplastic until 15% addition. This makes it more resistance to load and deflection along with heat resistivity whereas MFI decreases with addition of SSs in nylon-6 matrix. From DMA analysis it is observed that with inclusion of SSs the glass transition temperature tends to increase along with loss and storage modulus. Thermal and thermo-mechanical features tend to improve until 15% addition of SS in nylon-6 matrix. With further addition, the properties tend to be lowered because of poor adhesion of SSs with Nylon-6.

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Renewable Energy Focus
Volume 43, December 2022, Pages 74-83

Islanding power quality detection using lighting search optimization with deep learning model on distributed generation systems

C. Soumya [a], Praveen Raj [b], B. Deepanraj [c], N. Senthilkumar [d]

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https://doi.org/10.1016/j.ref.2022.08.007
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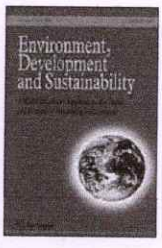
Abstract

Recently, the significant penetration of distributed generations (DGs) in distribution networks has made new challenging issues in network protection. A major challenge exists in the distribution networks in the identification of islanding conditions, where a portion of the distribution network with DGs is accidentally detached from the central grid due to protection relay and circuit breaker operation. Since it results in damaging the DGs and their equipment, effective islanding condition detection model becomes essential. Besides, non-detected islanding conditions can lead to voltage and frequency deviances from the normal ranges, inappropriate operation of protection, and personnel hazards. Therefore, the recent developments in deep learning (DL) can be applied to perform island power quality detection process. In this view, this article introduces an Islanding Power Quality Detection using Lighting Search Optimization with Deep Learning (IPQD-LSODL) model. The proposed IPQD-LSODL model mainly aims to find the events in islanding power quality (IPQ) and non-islanding power quality (NIPQ). The proposed model initially applies down-sampling empirical mode decomposition (DEMD) approach which effectively filters out the basic signal from the polluted ones. In addition, deep belief network (DBN) model is used to classify the events into IPQ and NIPQ. Moreover, the hyperparameters of the DBN method were optimally chosen by the use of LSO algorithm with an intention of accomplishing maximum classification accuracy. The performance validation of the IPQD-LSODL model is carried out and validated through comparison study with existing models. The IPQD-LSODL method achieved an accuracy of 99.91 percent in the class 5. The results implied the promising performances of the IPQD-LSODL method over recent approaches.

A critical evaluation of additive blended cashew nut shell liquid blended biodiesel performance in compression ignition engine

Published: 04 January 2022 25, 61–75 (2023)



Environment, Development and Sustainability

Aims and scope

Submit manuscript

N. Senthilkumar, Praveen Raj, J. Ranjitha & A. Muniappan

Abstract

Towards environmental sustainability, plant-based biofuels are utilized in diesel engines as an alternative to depleting fossil fuels for improved performance and emission reduction. In this research, experimental investigation of compression ignition (CI) diesel engine performance is done with two different fuels; neat diesel

ScienceDirect

Renewable Energy Focus
Volume 42, September 2022, Pages 8-23

Prediction-optimization of the influence of 1-pentanol/jatropha oil blends on RCCI engine characteristics using multi-objective response surface methodology

Athmakuri Ashok [a], Santhosh Kumar Gugulothu [a], Ragireddy Venkat Reddy [b], Ali Etem Gurel [c d], Balakrishnan Deepanraj [e f]

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Abstract

Despite their higher viscosity and longer ignition delay, alternative fuels like biodiesel can be used instead of fossil fuels. This study investigated the potential of the 1-pentanol (10, 20, and 30%) as the low reactivity fuel, which is a cetane value improver, and jatropha oil blended with diesel is considered the high reactivity fuel. 1-Pentanol was found to affect emission and combustion properties. Response surface methodology is adopted to forecast the operating parameters such as injection timing (23, 25, and 27° bTDC) and engine load (50, 75, and 100%). This ideal model is used to obtain engine characteristics for different fuel blends. The model's robustness was demonstrated because Theil's uncertainty in its predictive abilities was less than 0.1189(Theil's U2). With a mean absolute percentage error of less than 1.18%, Nash-Sutcliffe efficiency was outstanding (0.9885–0.9995). With the help of results obtained from experiments, various models were developed and validated. The ideal engine parameters found were 73% of engine load, PES of 24%, and FIT of 24.9° bTDC (advanced), and under this configuration, better engine characteristics are achieved. Also, ANOVA, a statistically valid test, is used to develop a regression model. The regression model is adequate for the following R^2 values obtained, according to the test results: BTE: 99.57%, BSFC: 98.86%, Pmax: 98.83%, NO_x: 98.22%, HC: 99.70% and CO: 98.38% respectively.

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ORIGINAL RESEARCH
published: 16 June 2022
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Iron Oxide Nanoparticles Synthesis From Vermicomposting Leachate and its Antioxidant Activities

Hudaverdi Arslan[1], Serpil Gonca[2], Zelal Isik[1], Sadin Özdemir[3], Mutlu Yalvac[1], Nadir Dizge[1], Balakrishnan Deepanraj[4,5] and Ghulam Abbas Ashraf[6]**

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Currently, nanotechnology and nanoparticles have been quickly emerged and have gained the attention of scientists due to their massive applications in environmental sectors. Nanotechnology also encompasses the ability to design, characterize, manufacture, and implement nano-sized structures. Today, metal oxide nanoparticles stand out in industrial applications in various fields of applied nanotechnology. Among metal oxide nanoparticles, iron oxide nanoparticles (FeO-NPs) are one of the widely used NPs. Green chemistry-based nanoparticles production is one of the most interesting topics in recent years. In the present study, we used vermicomposting leachate to synthesize FeO-NPs. First, vermicomposting leachate (VCL) was produced and then FeO-NPs was obtained from ferric chloride salt. FeO-NPs was characterized by scanning electron microscopy with energy dispersive X-ray spectroscopy (SEM/EDX) and X-ray diffraction (XRD). Additionally, the antioxidant activities of FeO-NPs synthesized from vermicomposting leachate (VCL-FeO-NPs) were evaluated by DPPH scavenging activity. The highest DPPH activities of VCL-FeO-NPs at 200 mg/L concentration were 93.54%. In addition, the nanoparticles showed significant DNA nuclease activity. The antimicrobial activities of VCL-FeO-NPs were studied in micro dilution methods and it exhibited moderate antimicrobial activity through Gr +ve, Gr –ve, and fungi. The nanoparticles showed more effective microbial cell inhibition activity against *E. coli*. Also, biofilm inhibition results were detected against *S. aureus* and *P. aeruginosa* were 66.05% and 67.29%, respectively.

Keywords: antimicrobial activity, antioxidant activity, biofilm inhibition, iron oxide nanoparticles, microbial cell viability, vermicomposting leachate

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INTRODUCTION

Nanotechnology (NT) and nanoscience is one of the remarkable areas of science dealing with using the structure of nanoscale (Kakakhel et al., 2021). NT is used in the medical field, pharmacology, optics, electronics, food industry, textiles, wastewater treatment, agriculture, (Azarang et al., 2014; Fernández et al., 2016). In addition, NT is used extensively in antimicrobial, catalysis and toxicity science (Potbhare et al., 2019; Umekar et al., 2021; Yabalak et al., 2022). The nanoparticles (NPs) are found in different types based on by their chemical structure. Nevertheless, some processes of

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Fuel

Volume 324, Part A, 15 September 2022, 124474

Production of HMF and DMF biofuel from carbohydrates through catalytic pathways as a sustainable strategy for the future energy sector

Huu Son Le [a], Zafar Said [b c], Minh Tuan Pham [d], Tri Hieu Le [e], Ibham Veza [f], Van Nhanh Nguyen [g], Balakrishnan Deepanraj [h i], Lan Huong Nguyen [j]

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https://doi.org/10.1016/j.fuel.2022.124474

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Abstract

In recent years, green energy sources have been proposed as alternatives for fossil fuels to meet energy demand while minimizing environmental pollution and global climate change. In this context, agricultural residues can be catalytically converted into furan derivatives. Among furan-based compounds, 5-hydroxymethylfurfural (HMF) and 2,5-dimethylfuran (DMF) are the valuable chemicals that can be converted into desired materials, including fuels. This review article discusses various catalytic HMF and DMF production pathways and the influence of feedstocks, catalysts, solvents, and hydrogen donors on the process yield. Additionally, reaction temperature and H_2 pressure effects on the feedstock conversion and HMF and DMF production yields are also presented. The primary attention has been devoted to the literature published in the last five years. However, additional relevant examples have also been discussed to clarify the topic further where necessary. This review aims at providing state-to-the-art information on the current developmental state of DMF and HMF production for researchers in this field.

Graphic abstract

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Journal of Cleaner Production
Volume 360, 1 August 2022, 131946

Forecasting of future greenhouse gas emission trajectory for India using energy and economic indexes with various metaheuristic algorithms

Hüseyin Bakır [a], Ümit Ağbulut [b], Ali Etem Gürel [b c d], Gökhan Yıldız [b], Uğur Güvenç [e], Manzoore Elahi M. Soudagar [f g], Anh Tuan Hoang [h], Balakrishnan Deepanraj [i j], Gaurav Saini [g], Asif Afzal [f k l m]

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https://doi.org/10.1016/j.jclepro.2022.131946
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Abstract

The accelerating increment of greenhouse gas (GHG) concentration in the atmosphere already reached an alarming level, and nowadays its adverse impacts on the living organisms, environment, and ecological balance of nature have been well-understood. India is one of the top countries that contribute the most to global GHG emissions. Therefore, it is of great significance to forecast the future GHG trends of the country in advance and accordingly take measures against the parameters that cause these emissions, considerably. In this direction, the present research has centered on forecasting the greenhouse gas trajectory of India with various metaheuristic algorithms. In this framework, marine predators algorithm (MPA), lightning search algorithm (LSA), equilibrium optimizer (EO), symbiotic organisms search (SOS), and backtracking search algorithm (BSA) are used for modeling the future GHG emission trajectory of India. Accordingly, the significant economic and energy indicators of India such as renewable energy generation, electricity generation from coal, electricity generation from gas, electricity generation from oil, gross domestic product, and population between 1990 and 2018 are collected to make a nexus with GHG emissions. As GHG emissions, CO_2, CH_4, F-gases, N_2O, as well as total GHG emissions are separately forecasted by the year 2050. To make a better comparison, each GHG emission data in the last year five years is used for the testing phase of the algorithms, and then statistically discussed in terms of R^2, MBE, rRMSE, and MAPE benchmarks. In the results, it is found that the R^2 value changes between 0.8822 and 0.9923 for CO_2, 0.2855–0.9945 for CH_4, 0.9–0.9904 for F-gases, 0.4655–0.9964 for N_2O, and 0.9016–0.9943 for total GHG emission, and the results in terms of rRMSE are very satisfying for all algorithms. In the study, it is forecasted that the two greenhouse gas emissions with the highest increase rate in 2050 will be between 2.5 and 2.87 times for CO_2 emissions and between 2.8 and 3.5 times for F-gases, compared to today's data. According to the results of the present paper, the total GHG emission for India is forecasted to be 2.1–2.4 times higher in the year 2050 as compared to today. Given all forecasting results together, it is seen that the MPA algorithm generally gives the best results according to the statistical metric results, while the LSA algorithm generally gives the worst results. Consequently, the present paper strongly reports that the decision-makers and policy-makers should take some serious steps in advance for the mitigation of GHG emissions, and to revise their energy investments in the upcoming years.

Introduction

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Fuel

Volume 319, 1 July 2022, 123711

Karanja oil transesterification using green synthesized bimetallic oxide catalyst, gCaO-CeO_2: Comparative investigations with the monometallic oxide catalysts on the catalytic efficacy and stability

Raja Sivashankar [a], Arunachalam Thirunavukkarasu [b], Rajarathinam Nithya [b], Venkatachalam Madhubala [b], Balakrishnan Deepanraj [c d]

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https://doi.org/10.1016/j.fuel.2022.123711

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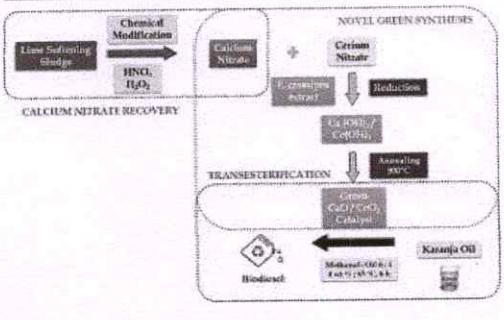
Abstract

In the present study, a novel plant-mediated approach was reported to synthesize a bimetallic oxide (BMO, gCaO-CeO2) catalyst from waste egg shells. Previously, an equi-molar mixture of cerium nitrate and shell recovered calcium nitrate was considered as precursor for *Prosopis juliflora* mediated green synthesis. The prepared gCaO-CeO2 was characterized by means of FT-IR, TG/DTA, XRD and surface area analyzer. X-ray diffraction results showed that the gCaO-CeO2 is thermally stable even after the calcination process at 800°C as the peaks for the cubic fluorite of cerium oxide (CEO) and cubic nature of calcium oxide (CO) were observed intact. Batch transesterification of karanja oil showed an improved catalytic activity for gCaO-CeO2 than monometallic oxides due to the increased basicity of the catalysts with the reduced temperature maxima. The highest fatty acid ethyl ester (FAEE) content of 96.17 % was attained for 6:1 mol ratio of ethanol-karanja oil over 4% (weight basis) of gCaO-CeO2 catalyst at 65 °C in 5 h. Further, the physico-chemical parameters of the transesterified products were found consistent with ASTM D6751 biodiesel standards. The study also reported the potential reuse of gCaO-CeO2 catalyst upto 6 operations with no appreciable loss in catalytic activity during transesterification.

Graphical abstract



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Sustainable Energy Technologies and Assessments

Volume 52, Part C, August 2022, 102160

Second law based thermodynamic analysis of crushed gravel sand and biomass evaporator assisted solar still

R. Dhivagar [a], B. Deepanraj [b c], M. Mohanraj [d], Hwai Chyuan Ong [e]

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Abstract

The thermodynamic analysis of crushed gravel sand and biomass evaporator assisted solar still (CBSS) using the second law has been explored in this study, and the results have been compared to conventional solar still (CSS) in same climatic conditions of Coimbatore city in India. The saline water and air vapour were pre-heated before entering the solar still basin using the thermal energy extracted from crushed gravel sand and biomass evaporator. The air vapour mixture and saline water temperature of CBSS were greatly improved by 23.2% and 23% than CSS, respectively. The maximal cumulative productivity and exergy efficiency of CBSS were found to be 51% and 35% greater than CSS, respectively. The diffused heat rate observed in both the solar stills were estimated using entropy analysis and the results revealed that the highest entropy observed in CBSS was 60.7% higher than CSS. In CBSS, the basin and saline water exergy destruction was about 12% and 22% higher than CSS, respectively. The results demonstrated that the CBSS can greatly lower the demand for potable water.

Introduction

Potable water is required for drinking, industrial processes, and agriculture, making it one of the most critical cornerstones for long-term economic and social success. The expanding global demand for potable water for industrial and domestic use has resulted in a growing supply–demand imbalance. Desalination of seawater is seen as a promising approach for addressing such concerns [1]. As a result, developing low-cost, energy-efficient desalination technologies is critical. One of the most basic solar systems for converting accessible wastewater or brackish water into freshwater is the single-basin solar still. This device is simple to make out of inexpensive and commonly available materials. Furthermore, its maintenance is low-cost, uncomplicated, and requiring no skilled work [2].

To improve the productivity of a solar still, many researchers have employed sensible heat storage materials such as sand, basalt stone, bricks, granite stones, and coarse aggregate. In Indian summer climate, Dumka et al. [3] employed cotton bags filled with sand in a solar still basin. According to the conclusions, the improved energy efficiency in the saline water mass of 40kg and 50kg were about 31.3% and 28.9%, respectively. By using 2cm basalt stones in the basin, Mohammed et al. [4] found the enhanced efficiency in a solar still by 33.7% than CSS. The productivity of a solar stills made of cement-coated red bricks was compared with CSS by Kabeel et al. [5] and found that the solar stills consisting of cement-coated red bricks had about 45% higher productivity and absorbs more heat than standard red bricks. Kalpesh Modi and Kuldeep Nayi [6] increased the thermal performance in a solar still using granite stones to retain excess heat harvested during the forenoon hours. According to the

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Sustainable Energy Technologies and Assessments

Volume 52, Part B, August 2022, 102090

Thermal performance, cost effectiveness and environmental analysis of a heat pump assisted regenerative solar still using slack wax as heat storage material

R. Dhivagar [a], B. Deepanraj [b c], M. Mohanraj [d], A. Prakash [e]

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https://doi.org/10.1016/j.seta.2022.102090

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Abstract

In this research, the thermal analysis of a heat pump assisted regenerative solar still (HPARSS) using slack wax heat storage material was assessed and compared the results with conventional solar still (CSS) under the same climatic conditions. In HPARSS, the thermal energy obtained during the condensation was regenerated using compression heat pump and used to pre-heat the inlet saline water before it reached the solar still basin. The outcomes showed that the HPARSS has the maximum cumulative productivity of about 16.5 kg/m^2 in 12 h observations which is 85.1% higher than CSS. The obtained energy and exergy efficiency of HPARSS were 67.4% and 81.9% higher than CSS, respectively. The maximum Coefficient of Performance (COP) of HPARSS was about 2.81. The diffused heat rate was estimated using entropy analysis and the results revealed that the maximum entropy attained in HPARSS and CSS were approximately 14.2 J/kg.K and 6.1 J/kg.K, respectively. The exergy destruction observed in HPARSS basin, saline water and glass cover were significantly reduced by 8.4%, 10.5% and 20.7%, respectively than CSS. The payback period (PBP) and CO_2 emissions of HPARSS were estimated by 2.8 months and 91.2 tons, respectively. The outcomes showed that the HPARSS can be significantly reduce the potable water demand.

Introduction

The demand for potable water is increasing as the global population grows. Domestic sewage water recycling and saline water purification from various techniques with high thermal efficiency and low environmental impact are thus required. As a result, solar still desalination is a viable option for producing potable water in regional and coastal locations. The productivity from CSS (2–5 kg/m^2/day) is not enough to satisfy the needs of the average household [1]. A variety of thermal energy storing materials namely fins, wicks, nanoparticles and preheating techniques with external auxiliary components were found to enhance the distillate significantly [2].

With heat storage material, Wen-Long et al. [3] improved the energy efficiency in a solar still by 43% than CSS. Kabeel et al. [4] enhanced the productivity by mixing paraffin wax with graphite nanoparticles in a ratio of about 80:20 which they found to be effective. The observed productivity was 8.52 kg/m^2 higher than CSS. Aside from that, the thermal conductivity has been significantly increased. It has been discovered by Kumar et al. [5] that, the improved productivity was obtained in noon periods when using Phase Change Material (PCM). The productivity and energy efficiency were enhanced by 120% and 700 %, respectively with the use of PCM when compared to CSS [6]. Many studies have employed this paraffin wax because of its high latent of

Environmental Science and Pollution Research
https://doi.org/10.1007/s11356-021-15565-z

Assessment of single slope solar still using block and disc magnets via productivity, economic, and enviro-economic perspectives: a comparative study

Ramasamy Dhivagar[1] · Murugesan Mohanraj[2] · Balakrishnan Deepanraj[3] · Vaiyapuri Senthil Murugan[2]

Received: 23 March 2021 / Accepted: 18 July 2021

Abstract
In this research, the productivity, economic, and enviro-economic analysis of single slope solar stills using block magnets (BMSS) and disc magnets (DMSS) were performed under the climatic conditions of Coimbatore city (latitude, 11° 01′ 68″ N, and longitude, 76° 95′ 58″ E), in India, 2019. The results observed in BMSS and DMSS were compared with conventional solar still (CSS) under the same climatic conditions. The usage of block and disc magnets in basin of solar still was improved the daily productivity significantly. The results showed that the performance observed in BMSS was notably higher than the performance of DMSS. The hourly productivity in BMSS was 5.8% and 13.7% higher when compared to DMSS and CSS, respectively. The cumulative productivity in BMSS, DMSS, and CSS were found to be about 3.15 kg/m^2, 2.82 kg/m^2, and 2.15 kg/m^2, respectively, for 12h observations. In economic analysis, the estimated payback period (PBP) of BMSS, DMSS, and CSS were about 3.6 months, 3.5 months, and 4.5 months, respectively. Furthermore, the CO_2 emission of BMSS, DMSS, and CSS were observed to be about 11.04 tons, 9.37 tons, and 6.45 tons, respectively. The overall observations showed that the magnetization of saline water has significantly improved the solar still performances.

Keywords Block magnets · Disc magnets · Economic · Enviro-economic · Productivity · Solar still

Introduction

A ratio of fresh water availability is limited due to population growth and globalization. The impact in demand of potable water is converted as a big threat to the human society. In order to overcome this, desalting the excess saline or brackish water will be the good option in this present situation (Sivakumar and Ganapathy Sundram 2013). Desalination using available renewable energy sources is one of the effective method to limit the demand of potable water. In these renewable energy source-integrated techniques, solar desalination has consistent rise in producing the purified water. Hence, the required potable water for remote area is extracted using solar distillation method which is very simple to operate. The device used for this solar distillation is called solar stills. The fabrication of solar stills is easy and is economically viable. The available saline water in the solar still basin gets evaporated due to higher heat accumulation by solar energy. The generated bouncy force on the saline water surface lifts the vapor towards to the inner glass cover. The higher temperature difference between the saline water surface and inner glass cover leads the condensation. Finally, the distillate is observed in collection jar. The productivity performance of solar stills have significantly improved with the use of different types of heat storage materials such as sand, gravels, jute cloth, cotton cloth, and paraffin wax (Dhivagar and Sundararaj 2018). Sharshir et al. (2018) improved the daily productivity in solar still using copper oxide and graphite nanoparticles by 41% and 32%, respectively, when compared to CSS. Mohamed et al. (2019) used basalt stones in basin of

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Published online: 26 July 2021

ScienceDirect

Sustainable Energy Technologies and Assessments

Volume 52, Part A, August 2022, 102054

Investigation of anaerobic degradability and biogas production of the starch and industrial sewage mixtures

Habibe Elif Gulsen Akbay [a], Fatma Deniz [a], Mehmet Ali Mazmanci [a], Balakrishnan Deepanraj [b], Nadir Dizge [a]

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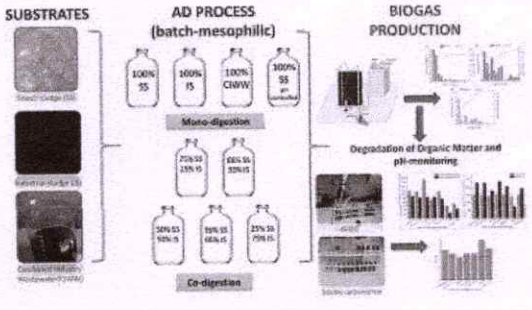
Abstract

Today, with the increase in industrialization, the disposal of organic sludge formed after industrial activities has started to pose a serious problem. For this reason, biogas production from such organic wastes under anaerobic conditions is very valuable in terms of both sustainable environmental policy and renewable energy recovery. In this study, the effects of mono-digestion and co-digestion of starch sludge (SS), industrial sewage sludge (IS), and wastewater (CIWW) from the cardboard manufacturing industry on the biogas production potential and the changes in parameters such as dissolved COD, carbohydrates and pH were presented. In addition, a pH-controlled study was carried out with the sample with the lowest final pH level (100% SS) after anaerobic fermentation. The mixtures were prepared to contain 100%SS, 100%IS, 100%CIWW, 75%SS-25IS, 66%SS-33IS, 50%SS-50%IS, 33%SS-66IS, and 25%SS-75%IS on a dry weight basis. The amount of biogas produced by 100%SS (257 mL) was almost 5 times greater than 100%IS (56 mL). The utilization of the CIWW together with SS and IS increased the biogas production potential approximately 10 times and 2 times, respectively. The highest biogas production was achieved with the anaerobic co-digestion (ACoD) of 25%SS and 75%IS as 332 mL. Under these conditions, biogas production increased by 29% and 493%, respectively, compared to mono-digestion of the substrates. As the SS ratio in the mixture increased, the pH value decreased due to VFA accumulation in the medium. In addition, there was a decrease of approximately 11% in biogas production. The soluble COD concentration of all mixtures increased after anaerobic fermentation except 100%IS. On the contrary, carbohydrate removal was observed in all reactors except 50%SS-50%IS mixture.

Graphical abstract



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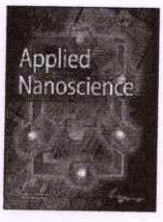
Processing of nanoreinforced aluminium hybrid metal matrix composites and the effect of post-heat treatment: a review

Review Article Published: 05 December 2022 13, 4075–4099 (2023)



Applied Nanoscience

Aims and scope

Submit manuscript

Nice Menachery, Shijo Thomas, B. Deepanraj & N. Senthilkumar

Abstract

The demand for cutting-edge materials with a high strength-to-weight ratio and economic considerations is steadily increasing. Lightweight materials such as aluminium (Al) and its alloys are attractive, but some properties such as low thermal stability and high wear rate limit the application of aluminium alloys (AA) to some extent. Many researchers have developed various composites to get around these

Influence of Toughness and Retained Austenite on Wear Behaviour of Carbide-Free Bainite in High Silicon Steel

Original Article Published: 24 November 2022 **76**, 2425–2434 (2023)

Transactions of the Indian Institute of Metals

Aims and scope

Submit manuscript

Rajan Kumar, R. K. Dwivedi, Virendra Pratap Singh, Basil Kuriachen & N. Anand Krishnan

Abstract

The goal of the current work was to investigate several heat treatment techniques to produce carbide-free bainite (CFB) in high silicon spring steel. Because silicon prevents the formation of carbide precipitation during austempering, it aids in the

Hindawi
International Journal of Photoenergy
Volume 2022, Article ID 3053317, 12 pages
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Review Article

Comprehensive Review on Modelling, Estimation, and Types of Faults in Solar Photovoltaic System

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Solar photovoltaic (SPV) system fault diagnostics is vital in advanced supervision because it can alert users to catastrophic failure or greater risks. To provide green and clean energy using solar, it is mandatory to analyse various faults associated with photovoltaic system which can result in energy deficit and system breakdown and may lead to fire hazards which are often difficult to avoid. Hence, as an endeavour to improve the efficiency level, more study beginning with modelling of SPV system with its parameter estimation and types of SPV faults is aimed in this work.

1. Introduction

The ever increasing energy demand of growing world population has required the use of all available energy resources. Solar energy has risen at the fastest rate of any type of electricity generation in the recent decade, spurred by concerns about climatic challenges, energy multifariousness, and supply reliability among national policy makers. Fossil fuel supplies are dwindling, while pollution is increasing, forcing humanity to reconsider the planned utilization of leftover energy wealth and the breakthrough application of various renewable energy resources. The national action plan on climate change [1] is the trigger element in writing this review paper. Regardless of the fact that solar PV systems contain stationary parts and need of little nurture, they are still susceptible to a variety of faults or malfunctions with the PV arrays, maximum power point tracking (MPPT), grounding, grid connection, batteries, and utility hook-ups [2]. PV modules are difficult to shut off totally during faults, especially on the DC side, because they are powered by sunlight throughout the day. As there are so many numbers of solar photovoltaic (SPV) modules which are coupled in a series-parallel topology, any failure among them might have an impact on the overall productivity of the SPV system. More crucially from a safety standpoint, a single failure might grow into several faults, which can lead to disaster. Furthermore, a standard series-parallel PV setup lifts the voltage and current ratings, which leads to huge defect current or DC arc risk.

Several mishaps, including fire dangers, have been observed in recent years, and the majority of these instances have took place owing to a lack of understanding of various forms of defects in SPV systems. The defect remained undiscovered and concealed in the system until the hazard caused catastrophic fire in Bakersfield's 383 kW SPV plant, 2009 [3], and Mount Holly's 1 MW SPV plant, 2011 [4], case studies. These fire threats demonstrate not just the flaws in traditional SPV array fault identification and safety techniques but also the immediate need for an alternative way to mitigate such problems. Fault diagnosis of SPV is useful for the technicians to detect, isolate, and troubleshoot the faults. The measured SPV parameters are checked with tolerances,

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Review Article

Identifying Influencing Factors of Road Accidents in Emerging Road Accident Blackspots

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This study deals with identifying the accident blackspots and the influencing factors causing accidents using factored analysis in a medium-sized city (Tirunelveli) in India. From the literature review, the geospatial technique to identify the blackspots and the factors causing accidents was used for analysis. The most influencing factors driving the accidents were identified and ranked based on the repetitive occurrence of accidents in the blackspot area. The spearman ranking system showed the correlation among the factors causing accidents. The factor analysis technique was utilized to identify the key factors driving the repetitive accidents and group them. This study will help transportation planners understand the factors causing accidents and take appropriate measures to reduce the casualties in the road construction planning stage and existing conditions.

1. Introduction

Worldwide, among the total road accident occurrences, nearly 1.3 million are fatal accidents, among which 90% of the fatal accidents occur in low-income people, such as the countries in Africa, and nearly 20–50 million nonfatal accidents contribute to disabilities [1]. From the statistical data obtained, it was observed that low and middle-income people worldwide have a high contribution to the occurrence of road accidents, and it was found that the total cost of accidents was found to be nearly 3 percent of the global gross domestic product [2]. The vulnerable road accident causers are cyclists, motorcyclists, and pedestrians. Road traffic accidents cost shares 3% of the total gross domestic product. It was noted that there was a continuous increase in fatal accidents from 1.15 million to 1.35 million during the period from 2000 to 2018 [3]. Traffic accidents are a major issue all around the world. Negative driving behavior, which is inherently influenced by traffic circumstances and infrastructure, among other factors, is one of the leading causes of traffic accidents [4, 5].

In 2019, nearly 4.37 lakhs road accidents were recorded on Indian roads, among which 1.54 lakhs accidents were fatal, and 4.39 lakhs of accidents were nonfatal but resulted in significant injuries, rendering people incapacitated. Two-wheelers caused the deadliest road accidents in 2019 (58,747 deaths), accounting for 38.0 % of all road fatalities, followed by trucks/lorries (22,637 deaths) (14.6 percent), cars (21,196 deaths) (13.7 percent), and buses (9,192 deaths) (5.9 percent). In India, road accident death has a share of 44% of

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A Smartphone Application for Skin Lesion Detection and Classification with Deep Learning Algorithms

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Abstract: The Skin Lesion (SL) classification has recently received a lot of attention. Because of the significant resemblance between these skin lesions, physicians spend a lot of time analyzing them. A Deep Learning (DL) based automated categorization system can help clinicians recognize the type of SL and improve the patient's health. In this research, DL approaches such as VGG-16, ResNet-50 and customized model are employed to detect the SL using a smartphone application. These models are trained on the SL classification dataset from the International Skin Imaging Collaboration (ISIC) 2019. The customized model over fits the other two models with a validation accuracy of 86.21%, whereas the validation accuracy of VGG-16 and ResNet-50 is 85.15% and 84.82%, respectively. Physicians will save time and have a higher precision rate in the automatic classification of SL utilizing DL.

Keywords: *Application development, Customized model, Deep models, Skin lesion classification, Tensor Flow Lite (TFL), Validation accuracy.*

1. Introduction

The World Health Organization (WHO) approximations that 2 to 3 million people are detected with SL each year around the world. [1]. The presence of SL is tightly connected to the prevalence of UV radiation caused by sunlight exposure [2]. About 60,000 people perished as a result of cancer caused by chronic sun exposure [3]. To improve a patient's prognosis, it is vital to detect cancer early. To address automated skin cancer diagnosis, several Computer-Aided Diagnostics (CAD) have been developed [4, 5]. Convolutional Neural Networks (CNN) that have been trained using dermoscopy image datasets are used in the majority of current techniques [6, 7]. However, there is a lack of dermatologists and dermatoscopes, particularly in rural areas limiting the adoption of a CAD system based on dermoscopy images [8].

In this circumstance, smartphones could be a beneficial tool for dealing with the problem. According to Mobile statistics report by Radicati Group the number of mobile users will be 7.1 billion worldwide and it also suggest to rise to 7.26 billion by 2022. In 2025, the number of mobile users worldwide is projected to reach 7.49 billion. According to a Deloitte study [10], India had 1.2 billion mobile consumers in 2021, with around 750 million of them using smartphones.

Harangi, B. suggested an approach that combines four CNN models: AlexNet, GoogLeNet, VGGNet, and ResNet [11]. The fusion approach presented in the study were used to identify seborrheic keratosis, melanoma, and nevus. Brinker, T.J. et al., used free source images of ISIC 2019 to train a ResNet-50 deep model [12]. Melanomas and atypical nevi are classified using trained model. Arik, A. et al. [13] and Demir, A. et al. [14] utilized dermoscopy images to train the standard CNNs such as ResNet and Inception-v3. Aggarwal, A. et al. presented an attention mechanism that aids CNNs in learning filters which selects significant pixel regions on a SL image to classify three forms of skin cancer [15].

Phillips, K. et al. developed an Android application (app) that discriminates between melanoma and non-melanoma SLs using a Support Vector Machine (SVM) trained on three categories of SLs with a dataset of 20 images [16]. Because it was trained with only a few samples, the

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Article

Single-Server Queuing-Inventory Systems with Negative Customers and Catastrophes in the Warehouse

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Abstract: In this paper, we studied single-server models of queuing-inventory systems (QIS) with catastrophes in the warehouse part and negative customers (n-customers) in service facility. Consumer customers (c-customers) that arrived to buy inventory can be queued in an infinite buffer. Under catastrophes, all inventory of the system is destroyed but customers in the system (on server or in buffer) are still waiting for replenishment of stocks. Upon arrival of n-customer one c-customer is pushed out, if any. One of two replenishment policies (RP) can be used in the system: either (s, S) or randomized. In the investigated QISs, a hybrid service scheme was used: if upon arrival of the c-customer, the inventory level is zero, then according to the Bernoulli scheme, this customer is either lost (lost sale scheme) or joining the queue (backorder scheme). Mathematical models of the investigated QISs were constructed as two-dimensional Markov chains (2D MC). Ergodicity conditions of the investigated QISs were obtained, and the matrix-analytic method (MAM) was used to calculate the steady-state probabilities of the constructed 2D MCs. Formulas for performance measures were found and the results of numerical experiments are presented.

Keywords: queuing-inventory system; catastrophes; replenishment policies; matrix-analytic method

MSC: 60J28; 60K25; 90B05; 90B22

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1. Introduction

Queuing systems (QS), in which to service the customer, along with an idle server, certain items are also required, are called queuing-inventory systems (QIS), see [1,2]. In other words, QISs simultaneously possess the properties of classical QS and inventory control systems (ICS). In classical QS, only an idle server is enough to service a customer (in multi-rate QS, several idle servers will be required at the same time), and in classical ICS, the inventory is released to customers instantly, i.e., in classical ICS, there are no servers for customer service. However, in many real ICS, delivery of the inventory to customers is carried out using certain devices (servers), and this process will require some positive time to complete. Since the flow of customers is a random one, and the service time (i.e., the process of issuing stocks to customers) is a random variable, a queue of customers is formed to receive stocks. In other words, in QISs, it is necessary to manage both service and inventory control processes simultaneously, i.e., it is necessary to organize the process of servicing of customers and manage the inventory of the system.

The first work devoted to the study of QISs models are the works [3,4]. After these works, models of QISs were intensively studied by various authors over the past three decades. A detailed overview of known results is set out in the work [5].

In each QIS model, it is necessary to make certain assumptions about the type of distribution functions (d.f.) of random variables that form the model under study, i.e.,